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**E1S SAW S223**

(56) Documents Cited:

**GB 2354035 A EP 1336704 A**  
**WO 1998/028506 A WO 1997/039212 A**  
**JP 2002168004 A US 3958381 A**  
**US 3793794 A**

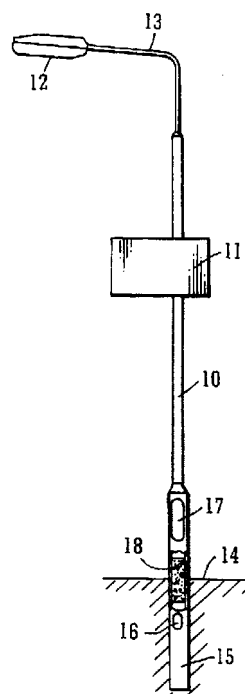
(58) Field of Search:

UK CL (Edition V) **E1S**  
INT CL<sup>7</sup> **E04H**

Other: **EPODOC, WPI & JAPIO**

(54) Abstract Title: **Method of reinforcing tubular columns**

(57) A method of reinforcing tubular columns such as lamp posts 10 particularly those of steel construction with their lower region 15 inserted into the ground 14 comprises the step of introducing into at least a part of the hollow interior of the column 10 a reinforcing material 18 to bridge the interior. The reinforcing material 18 may be a settable material such as polymeric foam, metal foam, foamed concrete or a light weight concrete which is introduced whilst still liquid and allowed to set within the column to form a reinforcing plug. Additional reinforcing means such as bars may be provided in the settable material. A passage through the material may be provided for passing cabling or the like through the reinforced region.



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

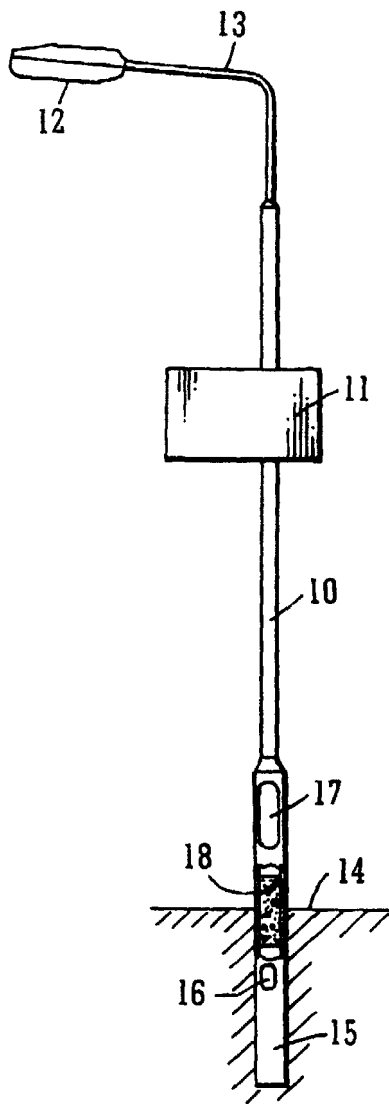


FIG. 1

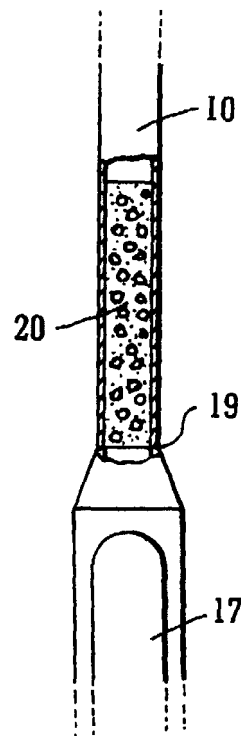


FIG. 2

## **STRENGTHENING/REINFORCING OF TUBULAR COLUMNS**

THIS INVENTION concerns a method of strengthening and reinforcing of tubular columns such as street lighting columns and the supporting columns of road traffic signs and/or telecommunications antennae and dishes. Such columns may be of parallel-sided circular or polygonal cross-section, conical circular cross-section or tapered polygonal cross-section.

Such columns are usually produced of steel with their lower regions inserted into the ground and extending upwards to a considerable height above the ground.

Over a period of time, the lower regions of such columns above and below the ground where they are exposed to atmospheric and other contamination, tend to corrode with the risk that they may fail and fall to the ground creating a severe risk to personnel in the vicinity.

Certain columns of this kind have a jointed connection at a position elevated from the ground where the cross-section changes from a broad base to a narrower upper portion and these connections are also susceptible to corrosion or failure.

An object of the present invention is to provide a method of strengthening such columns and reinforcing existing columns thus to extend the working life of them and avoid the need for premature removal and replacement which is an expensive and time-consuming procedure.

According to the present invention, there is provided, a method of strengthening/reinforcing a tubular column defining a hollow interior, comprising the steps of introducing into at least a part of the hollow interior of the column a reinforcing material to bridge the hollow interior thereof.

The tubular column may be of the kind used for street lighting columns and the supporting columns of road traffic signs and/or telecommunications antennae and dishes. The tubular column may be constructed of steel and, in use, has its lower region inserted into the ground and extending upwardly therefrom.

Preferably, the reinforcing material is a settable material introduced into the column interior while in a fluid condition and allowed to set such that the set material forms a contact with at least a part of the internal wall of the column.

The settable material may be a polymeric foam, a metal foam or so-called foamed concrete, or a lightweight concrete mix.

Pre-formed additional reinforcing means may be included in the reinforcing material.

A tubular or like member may be introduced prior to the material to provide, through the material a passage through which may be passed cabling or the like.

The reinforcing material may be introduced as a pre-formed plug of such material.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Fig. 1 illustrates a typical lighting column in which a part of the interior thereof is strengthened/reinforced by a settable material;

and Fig. 2 is an enlarged view of a similar column in which a part of the interior thereof well above ground has been strengthened/reinforced with a settable material.

Referring now to the drawings, in Fig. 1 there is shown a lighting column 10 having a traffic sign or the like 11 mounted thereon and a lamp 12 on an arm 13 at the top of the column.

The column is buried beneath ground level 14, at 15 and includes an aperture 16 for the introduction of underground cabling. An access door or flap 17 permits access to the interior of the column for electrical connection and switching as necessary.

At or in the region of ground level, such columns are prone to corrosion as a result of atmospheric and other contamination in that region as well as the weakening effect generated by sway of the column due to the windage effect of the sign 11, for example. This generates a fulcrum at ground level and over a period of time can result in the fatigue failure of the wall of the column at that level.

Weakening due to corrosion or metal fatigue can result in complete failure of the column at or near ground level, and regular monitoring of

such columns is required to ensure that they do not reach a dangerous condition. This results often in columns needing to be replaced prematurely and this in turn involves considerable expense.

In accordance with the invention, such a column may be strengthened prior to installation or reinforced during its useful lifetime by introducing, into the hollow interior of the column, a settable material such as foamed polyurethane or lightweight concrete in a region which is illustrated in Fig. 1 at 18 above and below ground level 14. Once the settable material has set it forms a rigid plug to bridge the hollow interior and to remain in contact with at least a part of the internal wall thereof. Expanding foams are ideal for this purpose since they will be certain to occupy fully the interior of the column over the intended portion of the height thereof. If necessary, blanking plates may be inserted to restrict the extent to be occupied by the core of material when set.

By introducing the core 18 the vulnerable region of the column is strengthened and reinforced thus to counteract the effects of corrosion and/or weakening due to movement of the column.

Since cabling extends through the interior of the column upwardly of the aperture 16, a tube or the like may be inserted into the column prior

to introduction of the settable material so that once the core 18 is set there remains a passage through which such cabling may be inserted and replaced.

Additionally, it may be appropriate to introduce and support reinforcing bars or the like into the interior prior to introduction of the settable material. In this case, the core 18 is thus strengthened further by such members.

Referring now to Fig. 2, in some columns there is provided a joint connection 19 part way up the column i.e. above the access door 17. Thus, the strengthening and reinforcing core illustrated here at 20, may be introduced at or in the region of such joint thus, again, to strengthen and reinforce the column in that region.

In addition to polymeric foams and lightweight concrete, other settable materials such as foams containing metals, may be used as the strengthening and reinforcing core.

By careful selection of the most appropriate material for the application, while the column may be strengthened thereby it may also be



afforded the necessary degree of flexibility. Thus, settable materials having some inherent flexibility when set may be used for this purpose.

In the case of some columns such as those used for supporting a surveillance camera or telecommunications antennae or dishes, it may be possible to reduce the inherent wall thickness of the column by wholly, or partially, filling the interior of the column with a settable material. Thus, the cost of manufacturing such columns may be reduced by using a thinner wall construction notwithstanding the cost of introducing the settable material.

Instead of introducing a settable material while in a fluid condition, a pre-formed plug of reinforcing material may be introduced, for example during manufacture of the column. IN this case, the plug may be slightly oversize and resilient or flexible to ensure a tight, even sealed, fit against the internal wall surface of the column.

The invention is to be construed as including a tubular column, strengthened/reinforced by the method described herein.

**CLAIMS**

1. A method of strengthening/reinforcing a tubular column defining a hollow interior, comprising the steps of introducing into at least a part of the hollow interior of the column a reinforcing material to bridge the hollow interior thereof.
2. A method according to Claim 1, wherein the tubular column is of the kind including street lighting columns and the supporting columns of road traffic signs and/or telecommunications antennae and dishes.
3. A method according to Claim 1 or Claim 2, wherein said tubular column is constructed of steel and, in use, has its lower region inserted into the ground and extending upwardly therefrom.
4. A method according to any preceding claim, wherein the reinforcing material is a settable material introduced into the column interior while in a fluid condition and allowed to set such that the set material forms a contact with at least a part of the internal wall of the column.
5. A method according to any preceding claim, wherein the settable material is a polymeric foam, a metal foam or so-called foamed concrete, or a lightweight concrete mix.

6. A method according to any preceding claim, wherein pre-formed additional reinforcing means are included in the reinforcing material.
7. A method according to any preceding claim, including the step of introducing into the column interior a tubular or like member, the member being introduced prior to the reinforcing material to provide, through the material, a passage through which may be passed cabling or the like.
8. A method according to Claim 1, comprising the step of introducing the reinforcing material as a pre-formed plug of such material, into the column interior.
9. A tubular column strengthened and reinforced by the method according to any one of Claims 1 to 8.



INVESTOR IN PEOPLE

Application No: GB 0313212.3  
Claims searched: 1-9

Examiner: Sarah Harrison  
Date of search: 30 September 2003

## Patents Act 1977 : Search Report under Section 17

### Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
X	1-4 & 7	GB 2354035	(Flude) see especially figure 3
X	1, 2 & 4-6	WO 98/28506	(Greene) see especially figure 1
X	1-3	WO 97/39212	(Lunds Energi AB) see especially figure 3
X	1, 2 & 4	JP 2002-168004	(EMS Japan KK) see especially figure 1
X	1, 2 & 4	US 3958381	(Meyer) see especially figure 1
X	1, 2, 4 & 6	US 3793794	(Archer et al) see especially figure 6
X, E	1, 2, 4 & 6	EP 1336704	(NTT Infrastructure Network Corporation) see especially figure 18

### Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category	P	Document published on or after the declared priority date but before the filing date of this invention
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

### Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC<sup>v</sup>:

E1S

Worldwide search of patent documents classified in the following areas of the IPC<sup>7</sup>:

E04H

The following online and other databases have been used in the preparation of this search report:

EPODOC, WPI & JAPIO